

**NATURAL RESOURCES CONSERVATION SERVICE
CONSERVATION PRACTICE STANDARD**

SURFACE DRAINAGE, MAIN OR LATERAL

(ft)
CODE 608

DEFINITION

An open drainage ditch constructed to a designed size and grade.

PURPOSE

To dispose of excess surface of subsurface water, intercept ground water, control ground water levels, provide for leaching of saline or alkali soils, or a combination of these objectives.

CONDITIONS WHERE PRACTICE APPLIES

All lands to be drained shall be suitable for agriculture after installation of required drainage and other conservation practices.

In areas where an outlet for the drainage system will be available, either by gravity flow or by pumping. The outlet shall provide for the quantity and quality of water to be disposed of. Consideration shall be given to possible damages above or below the point of discharge that might involve legal actions.

CRITERIA

The design and installation shall be based on adequate surveys and investigations.

Mains and laterals shall be located and designed to serve as integral parts of a surface or subsurface drainage system that meets the conservation and land use needs. The degree of drainage required by the crops shall be determined and expressed in terms of drainage coefficients or depth and spacing of drains.

The ditch capacity shall be adequate to provide for the removal of excess water, based on climatic and soil conditions and the needs of crops. The required capacity shall be obtained by determining the watershed area, the

required topographic, soil, and land use information, and use of the appropriate drainage coefficient curves.

The required capacity of open ditches for subsurface drainage in irrigated areas shall be determined by evaluating site conditions to include the following:

- irrigation water deliveries,
- irrigation canal or ditch losses,
- soil stratification and permeability,
- deep percolation losses,
- field irrigation losses,
- subsurface drain discharge, and
- quantity of surface water to be carried by the drainage ditch.

The hydraulic grade line for drainage ditch design shall be determined from control points, including elevations of significant low areas served by the ditch and hydraulic gradelines of any tributary ditches and the outlet. If control point elevations are estimated rather than computed from survey data, the hydraulic gradeline shall be no less than:

- One foot below fields that will receive normal drainage from ditches draining more than 1 square mile.
- 0.5 ft for ditches draining 40 to 640 acres.

For lands to be used only for water-tolerant vegetation, these requirements may be modified and the hydraulic gradeline set at ground level. These provisions do not apply to channels where flow is contained by dikes.

Conservation practice standards are reviewed periodically, and updated if needed. To obtain the current version of this standard, contact the Natural Resources Conservation Service.

Standard - 608-2

The effects of hydraulic losses caused by culverts, bridges, or other obstructions in the channel section shall be computed.

Drainage ditches shall be designed deep enough to allow for normal siltation. If needed, the design depth and capacity may be increased to provide adequate subsurface drainage or for normal flow. The increase shall be based on an evaluation of site conditions. The design ditch cross section shall be set below the design hydraulic gradeline and shall meet the combined requirements of capacity, limiting velocity, depth, side slopes, bottom width, and, if needed, allowances for initial sedimentation. Side slopes shall be stable, meet maintenance requirements, and be designed on the basis of on-site conditions.

The maximum permissible design velocity shall be based on site conditions and shall insure stability of the ditch bottom and side slopes. A desirable minimum velocity is 1.5 ft/s. On flat grades, a channel cross section shall be selected on the basis of the depth and maintenance requirements, which will result in the desirable minimum velocity if possible.

The velocity for newly constructed channels with drainage areas in excess of 1 square mile shall meet the stability requirements shown in the standard for Open Channels, (582).

Manning's formula shall be used in determining the design velocity, and the "N" value shall be based on alignment, probable vegetative growth expected with normal maintenance, other roughness factors, and the hydraulic radius. Unless special site studies are available to justify other values, the "N" values in Table 1 shall be used in solving the Manning formula for mains and laterals when determining the design for required capacity.

Table 1

Hydraulic radius	<i>n</i>
Less than 2.5	.040 — .045
2.5 to 4.0	.035 — .040
4.1 to 5.0	.030 — .035
More than 5.0	.025 — .030

Adequate berms shall be provided and shaped, as required by the following:

- To provide access for maintenance equipment,
- To eliminate the need for moving spoil banks in future operations,
- To provide for work areas and facilitate spoilbank spreading, to prevent excavated material from washing or rolling back into ditches, and
- To lessen sloughing of ditchbanks caused by heavy loads too near the edge of the ditchbanks.

Minimum berm widths shall be provided, as shown in Table 2, except where spoil is spread according to the requirements as shown in the standard for Spoil Spreading, (572):

Table 2

Ditch depth	Minimum berm width
Ft.	Ft.
2 — 6	8
6 — 8	10
More than 8	15

If spoil material is to be placed in banks along the ditch rather than spread over adjacent fields, the spoilbanks shall have stable side slopes. Provision must be made to channel water through the spoil and into the ditch without causing serious erosion.

Mains and laterals shall be protected against erosion by chutes, drop structures, pipe drops, other suitable structures, grassed waterway, or specially graded channel entrances where surface water or shallow ditches enter deeper ditches.

Grade control structures, bank protection, or other suitable measures shall be used if necessary to reduce velocities and control erosion.

Culverts and bridges shall have enough hydraulic capacity and depth for drainage needs and to minimize obstruction to flow.

Capacities of pipe or drop structures generally shall be determined by use of the applicable drainage coefficients with the “island-type” of construction used to protect the structure from washout.

Each structure for an open ditch system shall be designed according to NRCS standards for the kind of structure and type of construction used.

Vegetation shall be established according to the standard for Channel Vegetation, (322).

CONSIDERATIONS

Ditches that serve as outlets for subsurface drains should be designed for a normal water surface at or below the invert of the outlet end of the drain. The clearance between a drain invert and the ditch bottom should be least 1 foot for ditches that fill with sediment at a normal rate, except where lower valves are specified for a job because of unusual site conditions. The normal water surface is the elevation of the usual low flow during the growing season.

Effects on the water budget components, especially with regard to effect on runoff, soil water, and water tables.

Potential changes in soil moisture that will affect the growth of desirable vegetation.

Effect on ground water recharge.

Effects on the detachment and transport of sediment and chemicals and dissolved and sediment-attached substances into water courses.

Effects on the salinity of drained soils and downstream water courses.

Effects on wetlands.

Effect on the quality of ground water.

Potential for changes in downstream water temperatures.

Effects on downstream visual quality.

PLANS AND SPECIFICATIONS

Plans and specifications for constructing mains or laterals shall be in keeping with this standard and shall describe the requirements for constructing the practice to achieve its intended purpose.

OPERATION AND MAINTENANCE

Requirements for operating and maintaining all drainage mains and laterals having drainage areas in excess of 1 mi² shall be according to the standard for Open Channels, (582).